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Manufacturing Method For IC Sealing Material, Inlet for Non-Contact IC Card and the IC Card Produced Using This Method

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(54) [Name of the Invention]

Manufacturing Method For IC Sealing Material, Inlet for Non-Contact IC Card and the IC Card Produced Using This Method

(57) [Abstract]

[Problem]

The problem according to the present invention is to suggest a sealing (packaging) material where by providing a reinforcement plate the mechanical strength is increased and together with that it is possible to control the thickness to be thin so that it is stabilized to a degree where it is possible to be buried in the inner part, and an inlet used for noncontact IC card.

[Means To Solve the Problem]

IC packaging material that has a noncontact IC card inlet where on the substrate plate 10 with the formed on it antenna circuit 11 the IC 1 bare chip is mounted, and in order to protect the above IC chip the reinforcement plate 2 is provided, and that is a packaging material consisting of resin material used to bond the IC chip and the reinforcement plate and inorganic particles 5; where the largest particle diameter of the above inorganic particles is made to be the same as the gap between the IC chip and the reinforcing plate.

[Scope of the Claims]

[Claim 1]

IC packaging material characterized by the fact that it has a noncontact IC card inlet where on the substrate plate 10 with the formed on it antenna circuit 11 the IC 1 bare chip is mounted, and in order to protect the above IC chip the reinforcement plate 2 is provided, and that is a packaging material consisting of resin material used to bond the IC chip and the reinforcement plate and inorganic particles 5; where the largest particle diameter of the above inorganic particles is made to be the same as the gap between the IC chip and the reinforcing plate.

[Claim 2]

IC packaging material according to the above described Claim 1 characterized by the fact that the average particle diameter of the above described inorganic particles is 5 microns, and the maximum particle diameter is within the range of 40 microns ~ 50 microns.

[Claim 3]

Manufacturing method for the preparation of inlet used for noncontact IC card characterized by the fact that it is a manufacturing method for the preparation of inlet used in noncontact IC cards using the packaging material reported according to the above Claim 1 and Claim 2, where the above sealing material is provided on the IC chip, and after that the reinforcement plate is pushed and attached through pressure control, and the gap between the IC chip and the reinforcement plate is controlled.

[Claim 4]

Noncontact IC card that uses the inlet used for noncontact IC cards manufactured according to the method described in the above Claim 3.

[Detailed Explanation of the Invention]

[0001]

The present invention is an invention about a packaging material that is used in order to protect the integrated circuit board film with the mounted on it IC chip from the external environment effects such as external mechanical pressure applied on the card that is said to cause bending or point pressure on the IC chip, or provide moisture proof properties; and it is an invention about the manufacturing method for the preparation of inlet used for noncontact IC card that is produced by using the above packaging material.

[0002]

[Prior Art]

Regarding the noncontact IC card, the number of cases has increased where in order to reduce the cost or to make the production cards where the thickness of the IC chip part is decreased easy, the bump presenting IC chip is bonded with the substrate material sheet with the formed on it antenna pattern by using an anisotropic conductive film, which is a bonding material containing electroconductive particles.

[0003]

However, there are cases where the IC chip can be broken due to bending of the card and localized pressure, and there has been the problem of how to increase the mechanical strength of the card.

Because of that the IC chip part strengthening method has been proposed where a reinforcing plate is provided on the surface of the IC chip, etc., however, if a reinforcing plate is provided the thickness of the IC chip part becomes large.

Because of that it is necessary to strictly control the thickness of the IC chip part so that the IC chip can be buried in the inner part of the card that has a thickness of 0.76 mm (ISO Standard).

[0004]

[Problems to be Solved by the Invention]

The present invention is an invention that suggests a sealing (packaging) material where by providing a reinforcement plate the mechanical strength is increased and together with that it is possible to control the thickness to be thin so that it is stabilized to a degree where it is possible to be buried in the inner part, and it suggests an inlet used for noncontact IC card.

[0005]

[Means to Solve the Problems]

Regarding the present invention, it is an invention that has been devised in order to solve the above described problem, and because of that it is (1) an IC packaging material characterized by the fact that it has a noncontact IC card inlet where on the substrate plate 10 with the formed on it antenna circuit 11 the IC 1 bare chip is mounted, and in order to protect the above IC chip the reinforcement plate 2 is provided, and that is a packaging material consisting of resin material used to bond the IC chip and the reinforcement plate and inorganic particles 5; where the largest particle diameter of the above inorganic particles is made to be the same as the gap between the IC chip and the reinforcing plate.

[0006]

Also, the invention reported according to the above Claim paragraph 2 is an IC packaging material according to the above described Claim 1 characterized by the fact that the average particle diameter of the above described inorganic particles is 5 microns, and the maximum particle diameter is within the range of 40 microns ~ 50 microns.

[0007]

Also, the invention reported according to the above Claim paragraph 3 is a manufacturing method for the preparation of inlet used for noncontact IC card characterized by the fact that it is a manufacturing method for the preparation of inlet used in noncontact IC cards using the packaging material reported according to the above Claim 1 and Claim 2, where the above sealing material is provided on the IC chip, and after that the reinforcement plate is pushed and attached through pressure control, and the gap between the IC chip

and the reinforcement plate is controlled; and the invention reported according to the above Claim paragraph 4 is a noncontact IC card that uses the inlet used for noncontact IC cards manufactured according to the method described in the above Claim 3.

[0008]

As the packaging material, a packaging material is used where by using a material, which is obtained as inorganic particles are admixed into a sealing resin material, and when pressure is applied to the reinforcing plate from the top, the gap between the reinforcing plate and the IC chip is controlled by the diameter of the largest particles present between the above two, and this gap between the reinforcing plate and the IC chip becomes equal to this largest particle diameter.

[0009]

In this case, the smaller the ratio of the inorganic particles that have the largest particle diameter, the better, since when a large part of the particle diameters are on the small side, it is easy to control the flow properties and this is appropriate for the dripping of the sealing material and for the coating on fabric material etc.

The authors of the present invention have studied what is the appropriate particle diameter of such inorganic particles, and as a result from that the knowledge was obtained that the average particle diameter of the inorganic particles is 5 microns and that the maximum particle diameter is in the range of 40 microns ~ 50 microns.

[0010]

[Embodiment of the Invention]

The present invention is explained in details by using diagrams.

Figure 1 is a diagram explaining the inlet where on the substrate material film (10), the antenna circuit (11) and the contact circuit (12), which connects this antenna circuit and the IC chip (1), are formed, and on top of that the IC chip is mounted.

Regarding the substrate material film (10), mainly, 25-micron thick polyimide, polyethylene terephthalate etc., heat resistant films, are used, and on that the electroconductive antenna circuit, the contact point circuit are formed through etching treatment or through printing treatment.

For example, the method is used where copper foil, aluminum foil etc., are glued on a substrate material film or copper, aluminum are vapor deposited and after that a photosensitive resin layer is passed through the circuit mask and it is exposed to light and a resistor layer is formed, and on the side of this resistor layer the vapor deposited layer is etched and the circuit is formed.

Or, the method is used where by using electroconductive ink that is formed from copper or aluminum metal powder, screen-printing is conducted and the circuit is formed.

[0011]

On this substrate material film (1) with the formed on it antenna circuit (11) and contact point circuit (12), through the ACF (6) the contact point circuit and the IC chip bump (3) are connected so that electricity can pass through.

[0012]

Figure 2 is an enlarged sectional view diagram explaining the IC chip part of the inlet that has been sealed by a sealing material and where the IC chip (1) has been mounted on the substrate material film (10).

A 50 micron thick reinforcing plate (2) that is made from SUS301, SUS304 stainless steel etc., is provided at a size that covers and hides the entire IC chip body and the space between the substrate material film and the reinforcing plate is sealed using the resin material, which is the main component of the packaging material.

[0013]

As the resin that is used as the main component of the sealing material, there are epoxy resin, silicon resin, phenol resin, polyimide resin, acrylic resin, urethane resin, however, the epoxy resins and the silicone resins are widely used.

The materials obtained as alumina, silica, glass etc., insulation properties possessing inorganic particles are mixed and incorporated into these resins, are the sealing (packaging) materials used according to the present invention.

The average particle diameter of the inorganic particles is 5 microns, and the maximum particle diameter becomes a dimension that determines the gap between the IC chip and the reinforcing plate, and it is within the range of 40 ~ 50 microns.

Namely, when the average particle diameter is 5 microns, a large part of the inorganic material consists of inorganic material particles with a diameter smaller than 5 microns, and it is a good option if the large inorganic material particles (5a) are mixed and incorporated at an amount that is within the range of 5% ~ 20 %.

[0014]

The content of the inorganic particles is made to be within the range of 40 ~ 70 %.

This is because of the fact that if the content becomes high, the viscosity of the sealing material becomes high, and at the time of the coating of the sealing material it is easy for clogging of the nozzles to occur, and the coating feasibility properties are also decreased.

[0015]

The above-described sealing material with the admixed and incorporated inorganic particles is coated and after that the reinforcing plate (2) is placed on top.

When pressure is applied from the side of this reinforcing plate, the gap between the IC chip and the reinforcing plate becomes equal to the dimension of the largest particle diameter (5a).

This way, the gap is controlled by the largest particle diameter.....(a whole line is missing at the bottom of page 7 of the document – translator's note).....and it is possible to be maintained as a constant.

[0016]

This inlet where the gap between the IC chip and the reinforcing plate has been made constant is made into a card using the usual manufacturing method, and it is possible to obtain an IC card with a cross sectional structure as shown according to the presented in Figure 3.

[0017]

In Figure 3, (20), (30) represent the thermoplastic resin sheet.

By using thermoplastic resin the inlet with the mounted on it IC chip is enclosed and joined as a block and if it is hot pressed, the thermoplastic resin is mutually melted and it is possible to manufacture an IC card.

As the thermoplastic resin that is used here, there are low softening point temperature vinyl chloride, acrylonitrile – butadiene copolymer material, acrylonitrile – butadiene – styrene copolymer material, polyethylene, polypropylene, polymethyl methacrylate, ethylene – vinyl acetate copolymer etc., however, in recent years, because of the considerations with respect to the environment, polyester type materials, PET-G, high heat resistant PET-G/PC, oriented PET etc., are used.

Regarding the thickness of these thermoplastic resin sheets, it is such that after the block joining and hot press the thickness of the whole body is within the regulations (0.76 mm).

[0018]

[Results From the Invention]

As it has been described here above, according to the present invention a sealing material is used that is obtained as insulation properties possessing inorganic particles are admixed and incorporated into a sealing resin, and by that the gap between the IC chip and the

reinforcing plate is regulated through the largest particle diameter and because of that it is possible to stably define the gap by pressure control and not by mechanical control, which has been difficult to control.

[0019]

Also, it is possible to make consistently (stably) the thickness of the IC chip part of the inlet in such a state where the reinforcing plate has been provided so that it is 500 microns or less and the manufacturing of the noncontact IC cards with increased mechanical strength is easy.

[Brief Explanation of the Figures]

[Figure 1]

Figure 1 represents a top view diagram of the IC chip mounted on a substrate material film.

[Figure 2]

Figure 2 represents an enlarged cross sectional view diagram explaining the IC chip part in Figure 1.

[Figure 3]

Figure 3 represents a cross sectional view diagram explaining the noncontact type IC card.

[Explanation of the Symbols in the Figures]

- 1.....IC chip
- 10.....substrate material film
- 11.....antenna circuit
- 12.....contact point circuit
- 2.....reinforcing plate
- 20.....thermoplastic resin sheet
- 3.....bump
- 30.....thermoplastic resin sheet
- 4.....resin layer
- 5.....inorganic particles
- 5a.....maximum particle diameter inorganic particles from the inorganic particles 5
- 6.....anisotropic electroconductive film

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